Maryland Geological Survey

Prepared in cooperation with the
United States Geological Survey
and the
Commissioners of Carroll County

HYDROGEOLOGIC ATLAS TANEYTOWN and EMMITSBURG QUADRANGLE CARROLL COUNTY, MARYLAND

INTRODUCTION AND MAP 1. SLOPE OF LAND SURFACE

Quadrangle Atlas No. 16

HYDROGEOLOGY

By James M. Weigle and others

INTRODUCTION

This atlas describes some aspects of the geohydrology of the parts of northwestern Carroll County, Md., included in the Taneytown and Emmitsburg 7½-minute quadrangles. It is intended primarily as an aid in land-use planning and decision making, assessing potential environmental problems, and locating ground-water supplies. Land use in the Taneytown and Emmitsburg quadrangles is mainly agricultural, but Taneytown and dispersed residential housing occupy part of the land.

The climate is typical of the humid Piedmont region of Maryland. Average annual precipitation is approximately 43 inches. Precipitation is distributed fairly evenly throughout the year, although it is somewhat greater in summer and less in fall and winter.

The Taneytown quadrangle and the Carroll County part of the Emmitsburg quadrangle are drained by the Monocacy River and its tributaries, primarily Piney and Alloway Creeks. Topography is undulatory to rolling in the uplands; relatively steep slopes occur in most of the valleys. Maximum relief is approximately 260 feet, as compared with 470 feet in the Littlestown quadrangle immediately to the east of the Taneytown quadrangle.

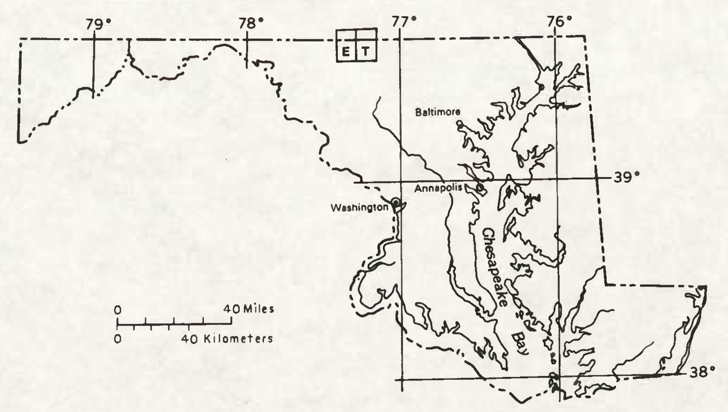


Figure 1.--Location of Taneytown and Emmitsburg Quadrangles.

HYDROLOGY

Precipitation recharges the local ground-water reservoirs, which consist of pore spaces in the weathered rock and fractures in the unweathered rock. Ground-water runoff from seeps and springs sustains the flow of streams during periods of no rain. The water table is the top of the zone of saturation in the rocks. It rises and falls in response to changes in ground-water storage resulting from imbalance between ground-water recharge and discharge. Rock that is in the saturated zone and can yield water to wells and springs is termed an aquifer. Some rocks are more productive aquifers than others, and yield water more freely to wells. Well yield is related to some degree to topographic position (often, valley sites are more productive than others), nature and thickness of the weathered zone, and extent to which the rocks have been fractured.

GEOLOGY

The Taneytown and Emmitsburg quadrangles in Carroll County are underlain by considerably jointed and faulted sedimentary rocks of Triassic age. The sedimentary rocks are overlain by soil and weathered rock (residuum), which together are referred to here as overburden. In some places, as along steep slopes, the overburden is thin or absent. Well records show that in other places it may be as much as 70 feet thick, but that its average thickness is about 11 feet.

The reader is referred to Cleaves, Edwards, and Glaser (1968) for additional information on the geology. Recently, detailed geologic mapping on a scale of 1:24,000 was completed in Carroll County, by the Maryland Geological Survey.

MAPS INCLUDED IN ATLAS

Map 1. Slope of Land Surface, by Photo Science, Inc.

Map 2. Depth to Water Table, by John T. Hilleary and James M. Weigle.

Map 3. Availability of Ground Water, by James M. Weigle.

Map 4. Constraints on Installation of Septic Systems, by James M. Weigle.

Map 5. Locations of Wells and Springs, by John T. Hilleary and James M. Weigle.

LIMITATIONS OF MAPS

Interpretation of available data, and some degree of judgment were required in preparing the maps in this atlas. The information shown on the maps does not eliminate the need for tests and detailed evaluation at specific sites.

SLOPE OF LAND SURFACE

Prepared by

Photo Science, Inc.

EXPLANATION

Four slope categories are shown on this map. Terrain having the maximum slope (greater than 25 percent) currently (1980) exceeds the maximum land slope permitted for the installation of domestic sewage-disposal systems (septic tanks) by the Carroll County Health Department. Other terrain categories are useful in planning certain construction activities involving local roads and drains, and in planning airport locations.

This map was prepared using topographic contour negatives by a process developed by the U.S. Geological Survey, Topographic Division. The process uses a semiautomated photomechanical process, which translates the distance between adjacent contours into slope data. The slope zones on the map are unedited. Proximity of the same contour or absence of adjacent contours may produce false slope information at small hilltops and depressions, on cuts and fills, in saddles and drains, along shores of open water, and at the edges of the map.

SELECTED REFERENCES

Cleaves, E. T., Edwards, Jonathan, Jr., and Glaser, J. D. (compilers and editors), 1968, Geologic map of Maryland: Maryland Geological Survey.

Meyer, Gerald, 1958, The ground-water resources in The water resources of Carroll and Frederick Counties: Maryland Department of Geology, Mines and Water Resources [1] Bulletin 22, p. 1-228.

Nutter, L. J., 1974, Well yields in the bedrock aquifers of Maryland: Maryland Geological Survey Information Circular 16, 24 p.

Nutter, L. J., and Otton, E. G., 1969, Ground-water occurrence in the Maryland Piedmont: Maryland Geological Survey Report of Investigations 10, 56 p.

Otton, E. G., and others, 1979, Hydrogeologic atlas of Westminster quadrangle, Carroll County, Maryland: Maryland Geological Survey Atlas No. 9, 5 maps.

Stose, A. J., and Stose, G. W., 1944, Geology of the Hanover-York district, Pennsylvania: U.S. Geological Survey Professional Paper 204, 84 p.

______1946, Geology of Carroll and Frederick Counties, in The physical features of Carroll and Frederick Counties: Maryland Department of Geology, Mines and Water Resources [1] p. 11-128.

University of Maryland, Maryland State Roads Commission, U.S. Bureau of Public Roads, 1963, Engineering soil map of Carroll County (1 sheet.)

U.S. Department of Agriculture, Soil Conservation Service, 1969, Soil survey, Carroll County, Maryland: 92 pages, 55 photomaps, 1 index.

______1971, Soils and septic tanks: 12 p.

U.S. Public Health Service, 1967, rev., Manual of septic-tank practice: 92 p.

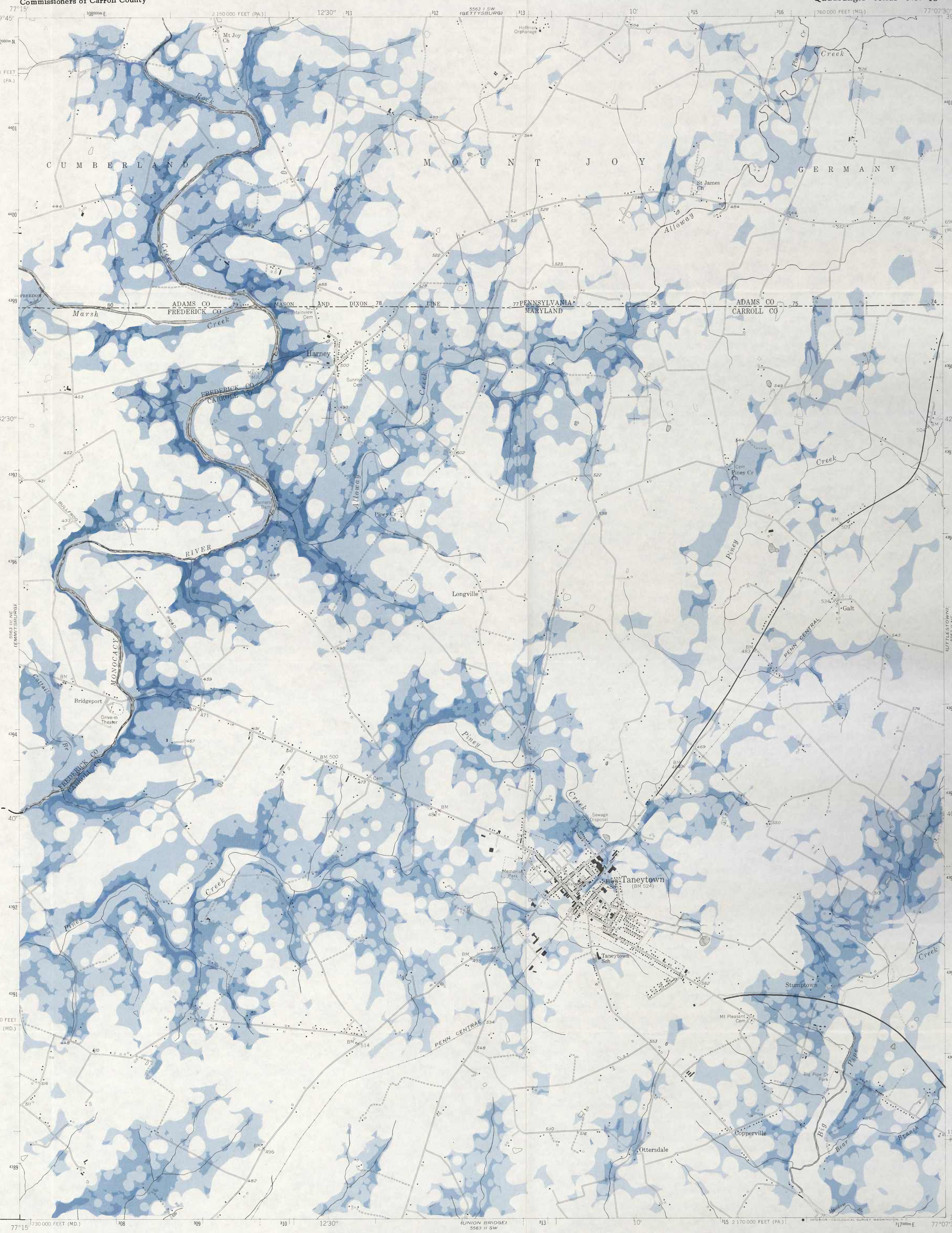
1/ The name of this agency was changed to the Maryland Geological Survey in June 1964.

CONVERSION FACTORS

In this atlas, figures for measurements are given in inch-pound units. The following table contains the factors for converting these units to metric (System International or SI) units:

Inch-pound unit	Symbol	Multiply by	Metric unit	Symbol
inch	(in.)	25.40	millimeter	(mm)
foot	(ft)	0.3048	meter	(m)
mile	(mi)	1.609	kilometer	(km)
square mile	(mi^2)	2.590	square kilometer	(km^2)
U.S. gallon	(gal)	3.785	liter	(L)
U.S. gallon per minute	(gal/min)	0.06309	liter per second	(L/s)
U.S. gallon per minute per foot	[(gal/min)/ft]	0.2070	liter per second per meter	[(L/s)/m]

EMMITSBURG QUADRANGLE SLOPE MAP NOT AVAILABLE



MAP 2. DEPTH TO WATER TABLE

Maryland Geological Survey Quadrangle Atlas No. 16

DEPTH TO WATER TABLE

By John T. Hilleary and James M. Weigle

EXPLANATION

This map shows the approximate depth to the water table (the top of the zone of saturation). Well and spring records in Meyer (1958) and considerable additional well data collected during this study were used in preparing the map. However, limits of areas where the water table is shallow (0 to 10 ft) were based largely on the perennial-stream network as shown on the topographic maps. Limits of areas where the water table is fairly deep (more than 35 ft) were based mainly on well records and topographic relations. In this region, water-table depths from 0 to 10 ft occur mostly in lowlands, and depths greater than 35 ft generally are restricted to hilltop areas.

Locally, and especially in the overburden, saturated zones may be perched above the main water table. Most of the perched zones are seasonal or even more short-lived. No attempt has been made to show them on this map. For more detailed information on local perching of ground water, see U.S. Department of Agriculture, Soil Conservation Service (1969).

The water table fluctuates with changes in ground-water storage, which are caused by relative changes in recharge and discharge. The fluctuations may be measured in days or less, or they may range up to years in duration. Seasonal fluctuations are cyclic and occur chiefly in response to increased ground-water losses due to greater evaporation and transpiration during the growing season. Typically, the water table is highest in late winter and early spring. Generally, it declines through late spring and summer, and through much of the fall. Seasonal water-table fluctuations tend to be greater under hilltops and smaller in valleys. Some effects of seasonal water-table decline are seasonal lowering of water levels in wells, and decreased flow of springs and "fair-weather" flow of streams. The reader is referred to Meyer (1958) for graphs of water-level fluctuations in representative observation wells in Carroll County, and to Otton (1979) for illustrations of statistical treatment of water-level fluctuations in several wells in Carroll and Baltimore Counties.

Because of water-table fluctuations the areas shown on this map are not static, but change seasonally and from year to year. The map shows generalized water-table conditions, and is intended for use on a reconnaissance basis only.

REFERENCES

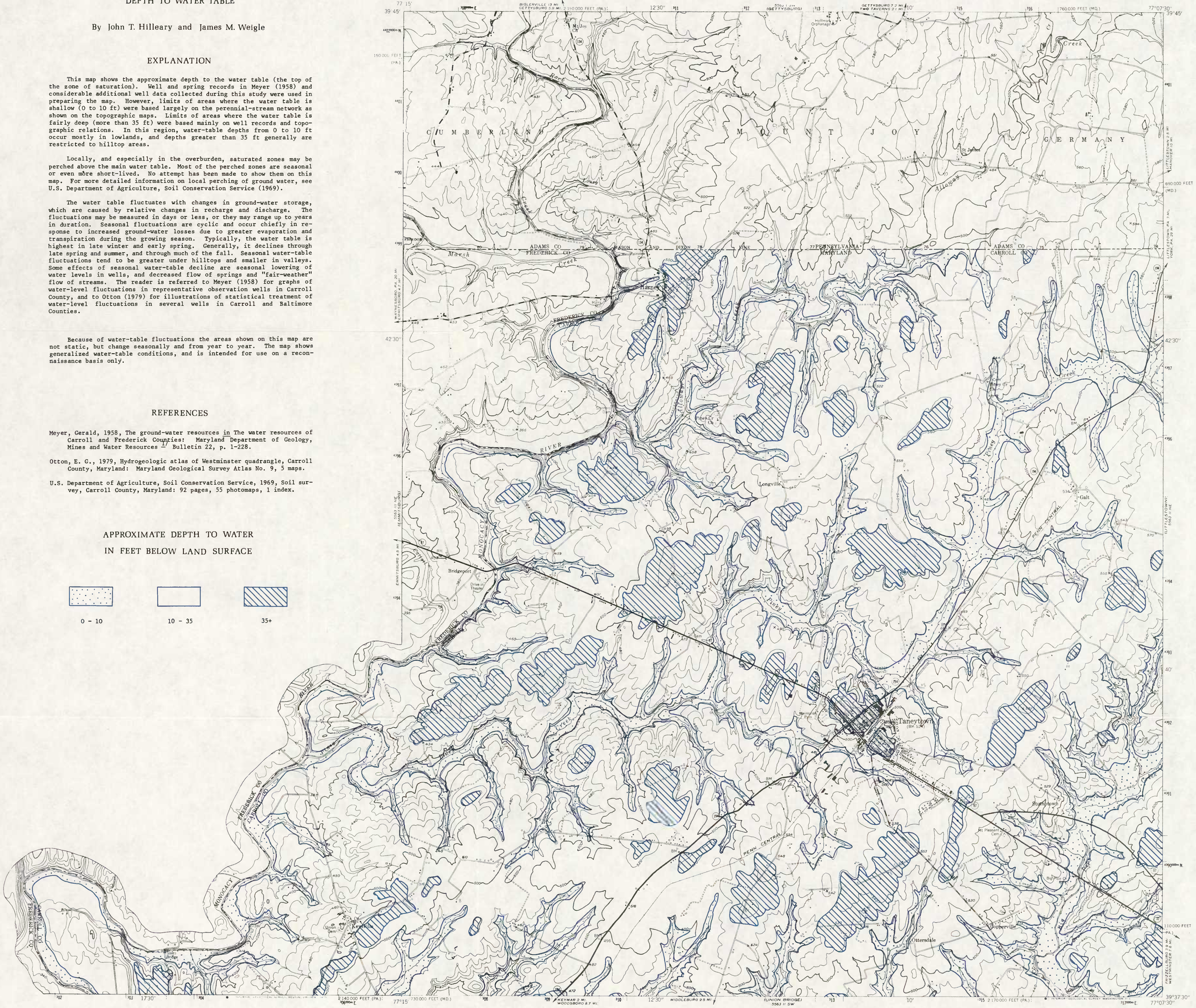
Meyer, Gerald, 1958, The ground-water resources in The water resources of Carroll and Frederick Counties: Maryland Department of Geology, Mines and Water Resources 1/ Bulletin 22, p. 1-228.

Otton, E. G., 1979, Hydrogeologic atlas of Westminster quadrangle, Carroll County, Maryland: Maryland Geological Survey Atlas No. 9, 5 maps.

U.S. Department of Agriculture, Soil Conservation Service, 1969, Soil survey, Carroll County, Maryland: 92 pages, 55 photomaps, 1 index.

APPROXIMATE DEPTH TO WATER IN FEET BELOW LAND SURFACE

0 - 10	10 - 35	35+



CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

1981

Prepared in cooperation with the
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Maryland Geological Survey

MAP 3. AVAILABILITY OF GROUND WATER

Quadrangle Atlas No. 16

AVAILABILITY OF GROUND WATER

By James M. Weigle

INTRODUCTION

Extensively fractured sedimentary rocks underlie the area shown in this atlas. The rocks are primarily sandstone, siltstone, and shale, and are of Triassic age. They are included in the New Oxford Formation, and (in a small area near the western boundary of Carroll Gounty) the Gettysburg Shale. Those formations are similar in lithology and in water-bearing characteristics, and no attempt is made to distinguish between them on this map or elsewhere in the atlas.

Available ground water in the rocks of these formations occurs in joints, in fracture zones associated with faults, along contacts between layers of sediments, and possibly in intergranular spaces in the coarser-grained sediments. It occurs also in intergranular spaces in the saturated part of the overburden.

For individual cases, well sites that are favorable on the basis of location at intersecting joints or proximity to faults may be located by using aerial photographs for topographic analysis and for mapping straight stream reaches. In preparing this map, however, reported well yields 1/ and specific capacities 2/ and their areal distribution were studied.

GEOHYDROLOGIC UNIT 5: This unit includes the Triassic rocks, which underlie the entire area mapped in the atlas. A designatory pattern for unit 5 is not considered necessary.

Units 1 through 4 are omitted from the explanation because they do not occur in this quadrangle. They are present elsewhere in Garroll County or nearby counties.

Figure 1 summarizes graphically the available well-yield and specific-capacity data for unit 5, based on yield-test results reported by drillers for 94 wells penetrating the rocks beneath the area shown on this map. The shapes of the graphs in figure 1 differ in part because specific capacity is expressed as yield per foot of drawdown, while well yield is expressed as gallons per minute without particular regard for amount of drawdown.

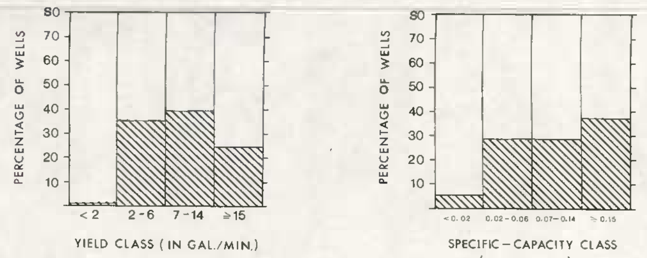

Figure 1.--Yields and specific capacities of wells in unit 5.

Well yields range from 1 to 300 gal/min, and the median yield is 8 gal/min. Specific capacities range from 0.01 to 2.1 (gal/min)/ft of drawdown, and the median value is 0.11 (gal/min)/ft. Figure 2 shows potential well yields based on the specific capacities summarized in figure 1 and assuming 100 ft of available drawdown for each well.

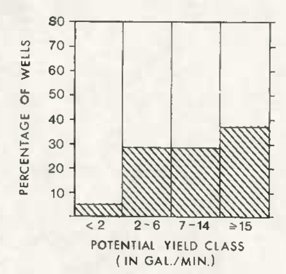

Figure 2.--Potential yields of wells in unit 5, based on 100 feet of drawdown.

About 99 percent of the yields are equal to or exceed 2 gal/min, the minimum yield considered adequate by the Maryland Water Resources Administration for domestic use. The specific-capacity values reported for about 5 percent of the wells are low (less than 0.02 (gal/min)/ft), but some or all of those wells might yield sufficient water for domestic needs provided the wells were deep enough to provide the necessary available drawdown.

Although alternate layers of sandstone, siltstone, and shale underlie the entire area, specific capacities vary over discrete areas rather than randomly. The resulting pattern is probably related to changes in lithology and to distribution of structural geologic features such as joints and faults--especially intersecting joints or faults.

Geohydrologic unit 5 is subdivided into two units (5A and 5B on map), on the basis of differences in water-bearing characteristics as indicated by specific capacity. Most wells drilled in unit 5A or 5B will have specific capacities respectively greater or less than 0.1 (gal/min)/ft of drawdown. Assuming 100 feet of drawdown, this means the majority of wells in unit 5A would have potential yields of more than 10 gal/min and the majority of wells in unit 5B would have potential yields of less than 10 gal/min.

EXPLANATION

5A — GEOHYDROLOGIC UNIT 5A: The rocks in this unit are moderately productive aquifers. Reported yields from 56 wells range from 4 to 300 gal/min, and the median yield is 11 gal/min; 39 percent of the wells yield more than 15 gal/min. Specific capacities of the 56 wells range from 0.06 to 2.1 (gal/min)/ft, and the median is 0.18 (gal/min)/ft.

5B — GEOHYDROLOGIC UNIT 5B: Reported yields of 38 wells range from 1 to 15 gal/min, and the median yield is 5 gal/min. This unit is less productive than unit 5A, yet only 3 percent of the yields reported for unit 5B are less than 2 gal/min. Specific capacities of the 38 wells in this unit range from 0.01 to 0.09 (gal/min)/ft, and the median is 0.04 (gal/min)/ft.

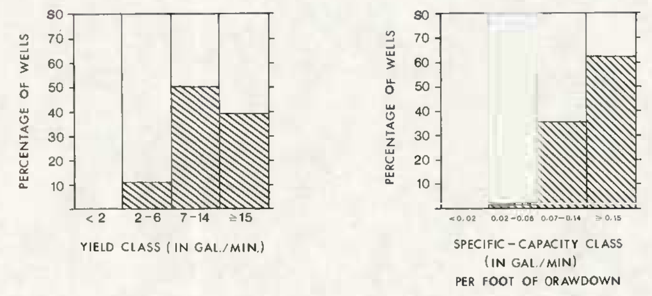

Figure 3.--Yields and specific capacities of wells in unit 5A.

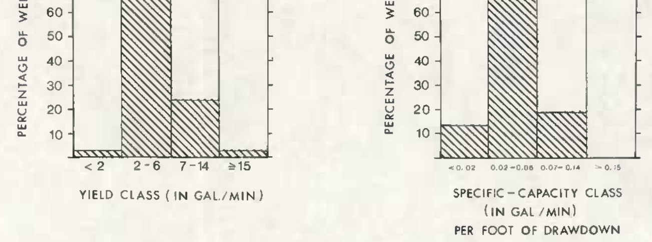

Figure 4.--Yields and specific capacities of wells in unit 5B.

SELECTED REFERENCES

Gleaves, E. T., Edwards, Jonathan, Jr., and Glaser, J. D. (compilers and editors), 1968, Geologic map of Maryland: Maryland Geological Survey.

Meyer, Gerald, 1958, The ground-water resources in The water resources of Carroll and Frederick Counties: Maryland Department of Geology, Mines and Water Resources 1/ Bulletin 22, p. 1-228.

Nutter, L. J., 1974, Well yields in the bedrock aquifers of Maryland: Maryland Geological Survey Information Circular 16, 24 p.

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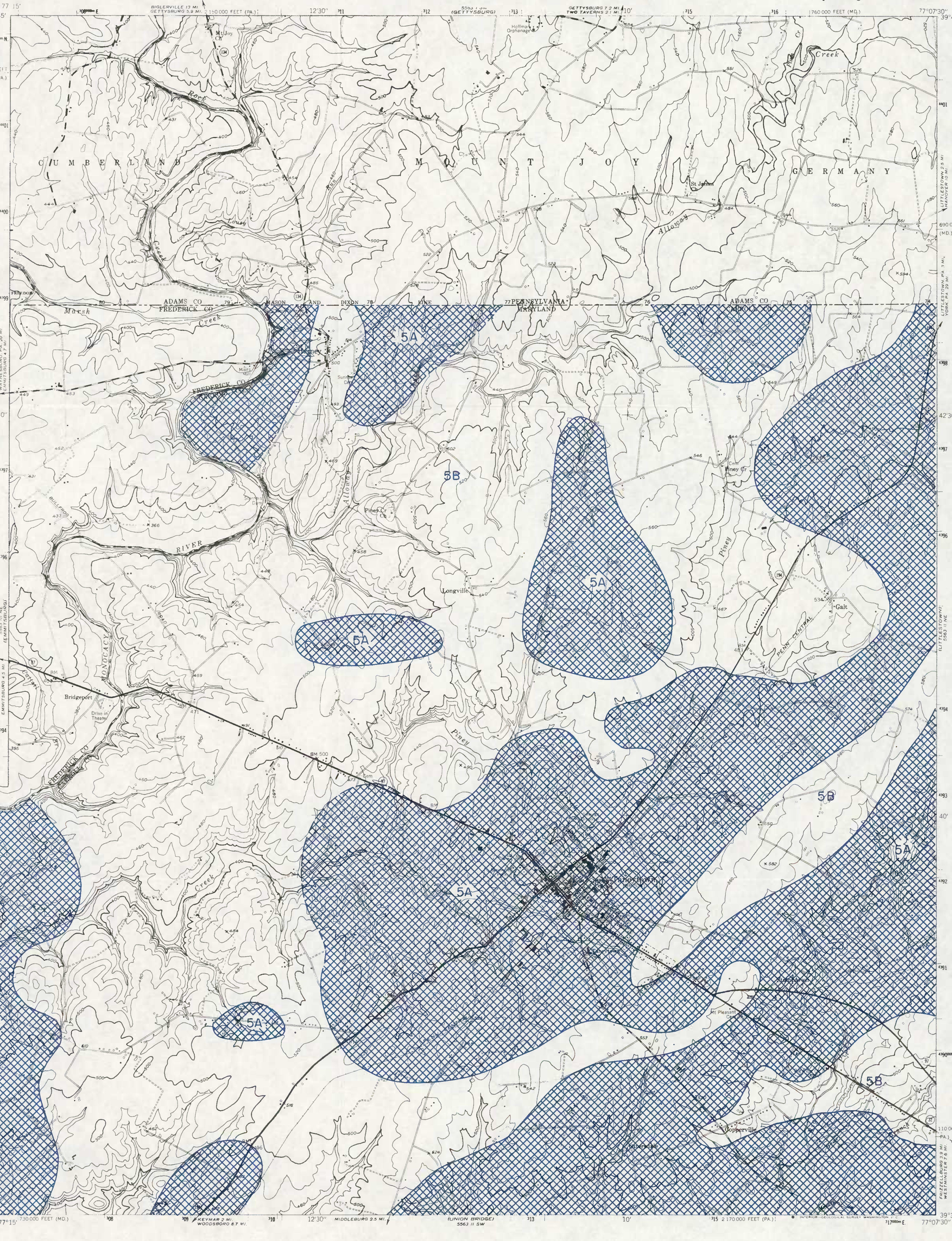
Stose, A. J., and Stose, G. W., 1946, Geology of Garroll and Frederick Counties, in The physical features of Carroll and Frederick Counties: Maryland Department of Geology, Mines and Water Resources 1/ p. 11-128.

1/ Specific capacity of a well is the yield per foot of drawdown of the water level in the well, and is commonly expressed in gallons per minute per foot of drawdown. For many domestic wells, the period of measurement ranges from 2 to 6 hours.

2/ The name of this agency was changed to the Maryland Geological Survey in June 1964.

3/ Well yields and specific capacities are based on yield tests by the well driller. The use of yield information in this atlas is limited to that obtained from tests at least 2 hours long, unless specified otherwise.



CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

1981

Prepared in cooperation with the United States Geological Survey and the Commissioners of Carroll County

CONSTRAINTS ON INSTALLATION OF SEPTIC SYSTEM

By James M. Weigle

SELECTION OF UNITS

The areas in the three units shown on this map differ widely in suitability for locating domestic liquid-waste disposal systems because of differences in land slope, depth to the water table, and thinness and differences in infiltration characteristics of the overburden.

The following shows the range in hydrogeologic limitations or constraints, for domestic septic systems in the various units.

MAXIMUM CONSTRAINTS	MODERATE TO VARIABLE CONSTRAINTS	MINIMUM CONSTRAINTS
I	II	III

FACTORS CONSIDERED, AND THEIR SOURCE OF EVALUATION

1. Steep slopes are considered to be a major contributing cause of failure of underground sewage-disposal systems (U.S. Public Health Service, 1967, p. 18; and U.S. Department of Agriculture, Soil Conservation Service, 1971, p. 8). Maryland Department of Health regulations (July 1964, Section 1, definitions, part 1.9) do not permit, as of 1980, the installation of underground domestic sewage-disposal systems where the slope of the land surface exceeds 25 percent. Land slopes were obtained from a slope map prepared by Photo Science, Inc. (Map 1).

2. Shallow depth to the water table is a major limiting factor in considering construction of a liquid-waste disposal system. In areas where the depth to the water table is less than 10 ft, the risk of failure of such a system is high. In addition, the chances of polluting the ground-water supply are greater where the water table is shallow than where it is fairly deep. The 10-ft minimum depth was determined in the following manner: (a) The recommended depth to the bottom of the tile field is at least 3 ft below the land surface (U.S. Department of Agriculture, Soil Conservation Service, 1971, p. 3); (b) a minimum depth of 4 ft between the base of the tile field (absorption trench) and the underlying water table is recommended (U.S. Public Health Service, 1967, p. 11); and (c) a 3-ft additional depth is suggested to allow for seasonal variations in position of the water table, which commonly fluctuates through a 3-ft range in the Piedmont valleys. The extent of the areas having a shallow water table was taken from map 2.

3. Where bedrock crops out or occurs near land surface, construction of underground disposal systems is not feasible. Those areas generally occur where land-surface slopes are steep, and are included in unit I. Mappable areas where depth to bedrock ranges from 4 to 7 ft are included in unit II. Depth to bedrock was determined primarily from well logs, and to a lesser extent from soils maps (U.S. Department of Agriculture, Soil Conservation Service, 1969).

4. Infiltration rates also are a limiting factor in considering construction of liquid-waste disposal systems. Overburden having low permeability may not accept the effluent of a normal household. Where the permeability is high, the effluent may be inadequately renovated. Infiltration rates were determined primarily on the basis of data collected by Carroll County sanitarians during percolation tests conducted according to standardized procedures established by the Maryland Department of Health [1/].

5. Floods can cause dispersal of sewage and possible physical damage to disposal systems. Most valleys in the Taneytown and Emmitsburg quadrangles are subject to periodic flooding. In these quadrangles, the flood-prone areas lie entirely within the areas of shallow water table (map 2) and are therefore included in unit I on map 4.

SELECTED REFERENCES

Cleaves, E. T., Edwards, Jonathan, Jr., and Glaser, J. D. (compilers and editors), 1968, Ceologic map of Maryland: Maryland Geological Survey.

Meyer, Cerald, 1958, The ground-water resources in The water resources of Carroll and Frederick Counties: Maryland Department of Geology, Mines and Water Resources [2/] Bulletin 22, p. 1-228.

Otton, E. C., and others, 1979, Hydrogeologic atlas of Westminster quadrangle, Carroll County, Maryland: Maryland Ceological Survey Atlas No. 9, 5 maps.

University of Maryland, Maryland State Roads Commission, U.S. Bureau of Public Roads, 1963, Engineering soil map of Carroll County (1 sheet).

U.S. Department of Agriculture, Soil Conservation Service, 1969, Soil survey, Carroll County, Maryland: 92 pages, 55 photomaps, 1 index.

_______1971, Soils and septic tanks: 12 p.

U.S. Public Health Service, 1967 rev., Manual of septic-tank practice: 92 p.

1/ The percolstion test conducted in Carroll County (1979) is performed as follows: A 2- to 3-ft-wide pit is dug to the depth to be tested, and a 1-ft-square hole is hsnd-dug 1-ft deep in the floor of the pit. The 1-ft hole is filled with water, and the time required for the water level to drop the second inch of a 2-inch decline is measured. For the test to be rated "passing", the time required for the water-level to drop the second inch must be between 2 snd 30 minutes.

2/ The name of this agency was chsnged to the Maryland Geologicsl Survey in June 1964.

MAP UNITS

UNIT I includes areas where the depth to the main water table ranges from 0 to 10 ft (map 2) and areas where the land slope exceeds 25 percent (map 1). This unit includes valley areas subject to periodic flooding and most of the areas where the overburden is thin or absent.

Results of 45 percolation tests in unit I show a high (62 percent) incidence of failure. For those tests which passed, the average percolation rate was 14 min/in., and the range was from 3 to 29 min/in. For those which failed, the percolation rate was slower than 30 min/in.

UNIT II includes areas underlain by sedimentary rocks, chiefly the New Oxford Formation, but including a small area of the Cettysburg Shale in the northwestern part of the map. The rocks are primarily red-brown shale, siltstone, and sandstone. Unit II includes areas where the depth to the water table is generally between 10 and 35 ft, and most of the areas where the land-surface slope is between 10 and 25 percent. Thickness of overburden ranges generally from more than 3 ft, to 7 ft. In some places, the limiting conditions are variable, and exceed the above ranges in small, discontinuous areas.

Percolation-test data for unit II show a moderately high incidence of failure. Of 154 tests, 39 percent failed, mostly because of excessively slow percolation.

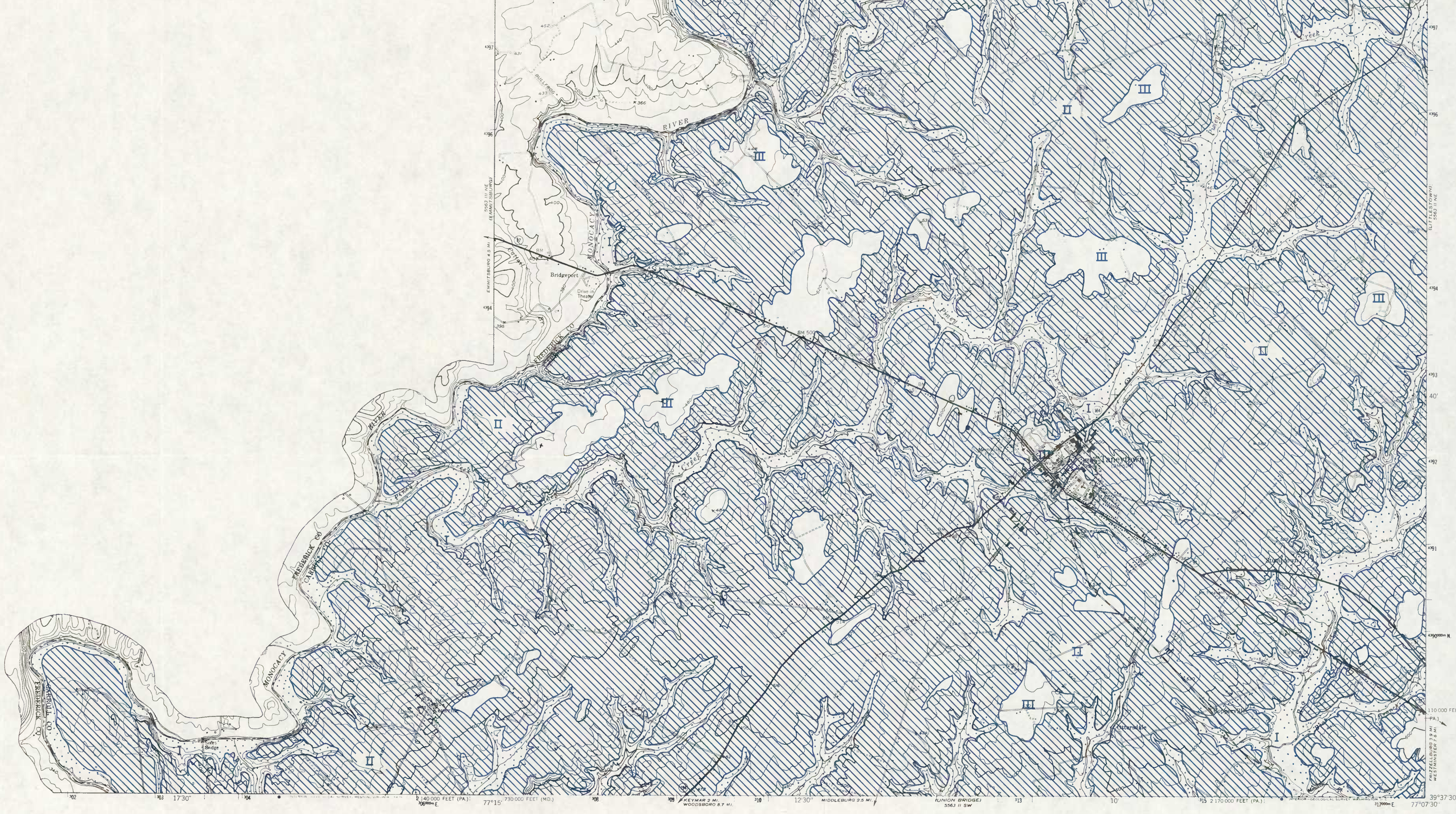
UNIT III includes areas underlain by sedimentary rocks of the New Oxford Formation, consisting mostly of reddish-brown shale, ailtstone, and sandstone. Includes upland areas, in nearly all of which the land-surface slope is from 0-5 percent, and the depth to the water table is more than 35 ft. The depth to bedrock is greater than 7 ft.

Percolation-test data available for unit III show a low (about 6 percent) incidence of failure.

Maryland Geological Survey

MAP 4. CONSTRAINTS ON INSTALLATION OF SEPTIC SYSTEMS

Quadrangle Atlas No. 16



CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

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UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

Prepared in cooperation with the United States Geological Survey and the Commissioners of Carroll County

Maryland Geological Survey Quadrangle Atlas No. 16

MAP 5. LOCATIONS OF WELLS AND SPRINGS

LOCATION OF WELLS AND SPRINGS

By John T. Hilleary and James M. Weigle

EXPLANATION

Information for wells and springs shown on this map is given by Meyer (1958), or is on file with the U.S. Geological Survey, Towson, Md., and the Maryland Geological Survey, Baltimore, Md. Logs and well-construction records are available for most wells shown. In addition, a report of basic ground-water data available for Carroll County is being prepared.

The wells and springs are numbered according to a coordinate system by which each Maryland county is divided into 5-minute quadrangles bounded by lines of latitude and longitude. The first letter of the well number identifies a 5-minute section of latitude; the second letter identifies a 5-minute section of longitude. The pairs of letters are followed by numbers assigned serially to wells. The letter-number term designates the well with respect to the 5-minute quadrangle, and is preceded by an abbreviation of the county name. Thus, well CL-AB 7 is the seventh well inventoried in 5-minute quadrangle AB in Carroll County. In reports describing wells in only one county, the county prefix letters frequently are omitted from the well-designation term. The numbering system currently in use (1980) differs slightly from that used in earlier published reports, such as that by Meyer (1958). In the 1958 report, well CL-AB 7 was designated as Car-Ab 7. The use of lowercase letters in well designation was discontinued because of a changeover in 1970 to a computer system for storing and retrieving well information.

10

WELL AND NUMBER

4

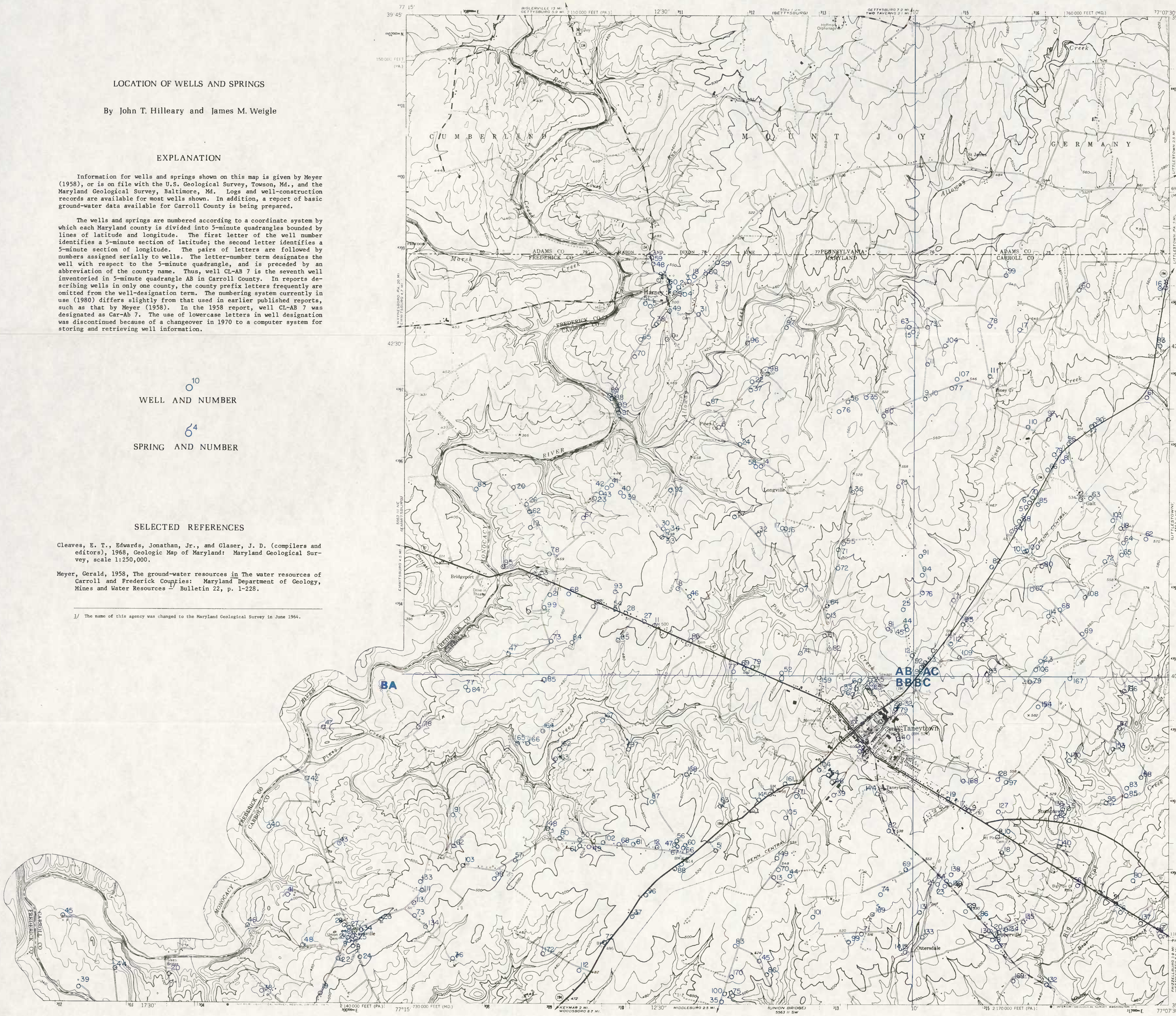
SPRING AND NUMBER

SELECTED REFERENCES

Cleaves, E. T., Edwards, Jonathan, Jr., and Glaser, J. D. (compilers and editors), 1968, Geologic Map of Maryland: Maryland Geological Survey, scale 1:250,000.

Meyer, Gerald, 1958, The ground-water resources in The water resources of Carroll and Frederick Counties: Maryland Department of Geology, Mines and Water Resources 1/ Bulletin 22, p. 1-228.

1/ The name of this agency was changed to the Maryland Geological Survey in June 1964.



ADDITIONAL NOTE

Records of wells shown on this map are contained in: Hilleary, J.T. and Weigle, J.M., 1982, Carroll County ground-water information: Well records, spring records and chemical quality data: Maryland Geological Survey, Basic Data Report No. 12, 252 p.

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

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